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HEMM Workshop EMRTC

Dr. Robert Bishop
June 28-30, 2022



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Name: Richard Kieltyka, Q/15

Date: 06/15/2022

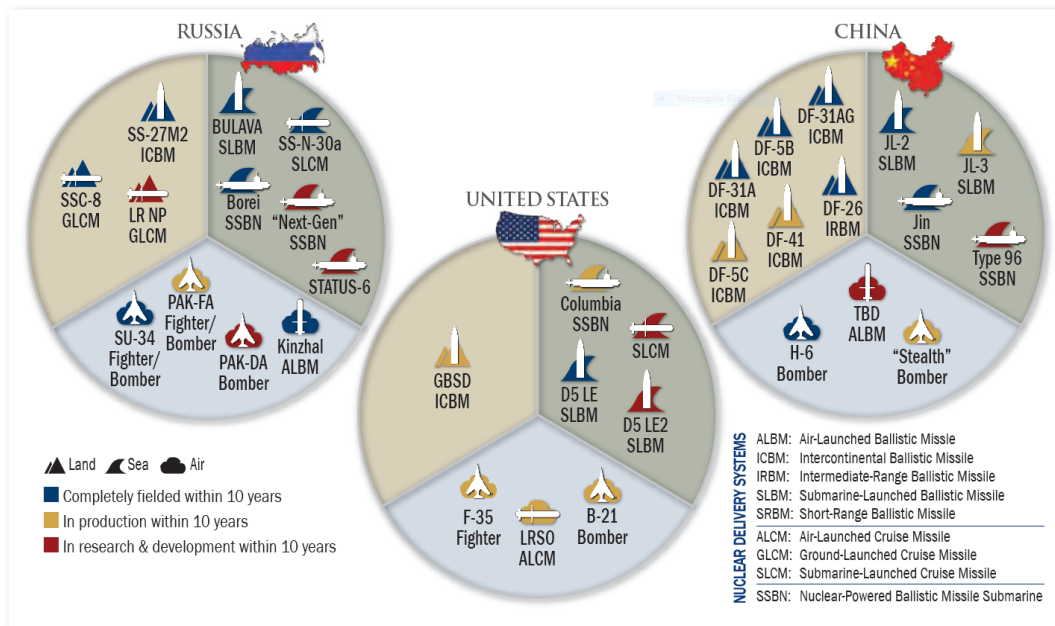
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Our Mission YouTube Video

<https://youtu.be/fmP-ymRhI9U>

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Los Alamos Mission Critical to US and our Allies' Security

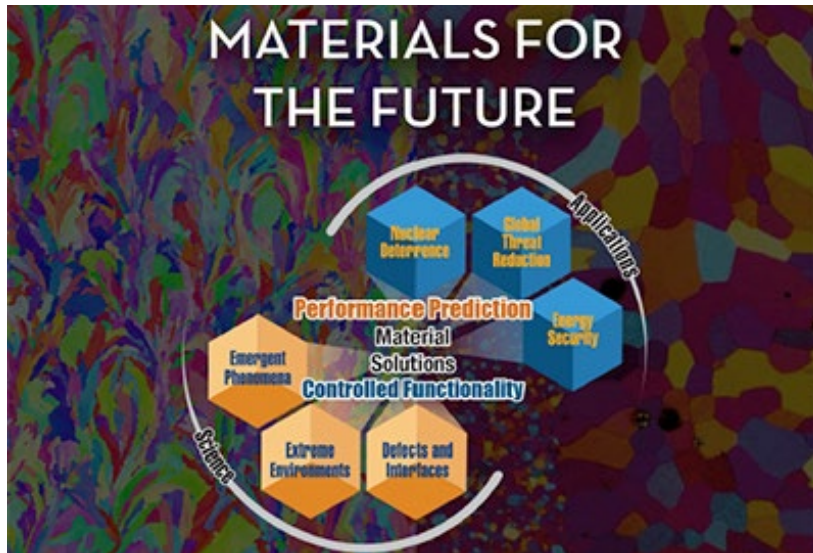


As we enter another great powers struggle, LANL must take a strong leadership role in shaping the future deterrence of the US and our allies.

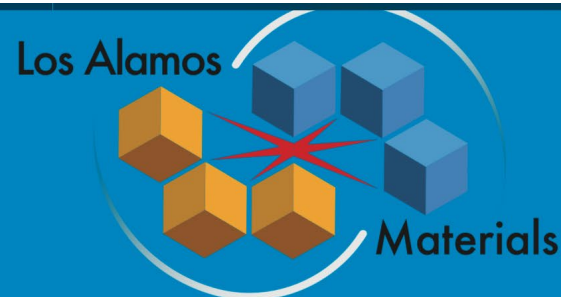
- Los Alamos is responsible for the NATO deterrent, is critical to the UK at-sea deterrent, and has designed over 90% of the current US stockpile.
- Los Alamos **MUST** lead the stockpile into the next phase of nuclear deterrence.
 - Who else is going to do it?
- To succeed, we need to leverage across several funding sources and sites to both answer the tactical needs of the current stockpile and to develop capabilities and personnel to meet future challenges.

Mission: To support our nations' current and developing stockpile through excellence in fundamental and foundational science, design and system engineering; advanced system analysis; and program management. To lead the development of the future stockpile and deterrence.

Los Alamos National Laboratory Capability Pillars—Energetic Materials



ENERGETIC MATERIALS



Energetic materials comprise explosives, pyrotechnics, and propellants. The science of energetic materials is dedicated to developing means to predict performance and safety characteristics with high fidelity. This is a particular challenge and is predicated on materials science and engineering, physics, chemistry, and dynamic response in extreme conditions. Fundamental elements of these complicated composite materials remain grand challenges—from the design of high-energy metastable molecules, to the engineering of composite formulations, to the processing parameters that link to safety and performance characteristics in as-yet undetermined ways. Key elements include crystalline mechanics, grain dynamics, multiphase interfaces, thermal and mechanical damage, and failure—all linked to multistep and high-rate chemistry and shock physics. A future revolution in our understanding and predictive capability for energetic materials behavior and responses is dependent upon sustained focus and advances in materials research and development.


Los Alamos Leadership



The Laboratory's breadth and depth in energetic materials—with nuclear application experience and integrated modeling and simulation capabilities—are unique within the National Nuclear Security Administration and the country. Here, an explosive compound is heated just past its melting point and is poured from the kettle into the experimental apparatus.

Materials for the Future

High Explosive Strategy Document and Explosive Maturation Standard

| | | |
|--|-----------------|-----------------------|
|  <div style="margin-left: 10px;"> Associate Level Directorate for Weapon Engineering (ALDW) Administrative Document </div> | | |
| Explosives Maturation Standard Los Alamos National Laboratory • P.O. Box 1663, Los Alamos, NM 87545 | | |
| Number | Revision | Effective Date |
| ADW-AD-0041U | A | March 25, 2022 |

| | Name | Z # | Title/Org | Date |
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Los Alamos Weapon Engineering is Critical and Unique

- Time and Life of Stockpile Scope: LANL must excel in supporting the current stockpile (surveillance), supporting the programs of record (B61-12, W88 Alt 370, W80-4, W76-2, W87-1, and the W93) as well as future programs (NVIS, HDBT, etc..)
- Capability Breadth: LANL must succeed in fundamental and foundational science, component design, qualification and production, and system engineering and program management.
- Operational Complexity: LANL manages experimental sites, large computer systems needs, and investigatory facilities (WESTEC).
 - Explosive Facilities
 - Nuclear Facilities
 - Basic Research Laboratories





*"We are one team, dedicated solely
to the success of our Laboratory's
national security mission."*

—Thom Mason, Laboratory Director



Laboratory Director
Thom Mason



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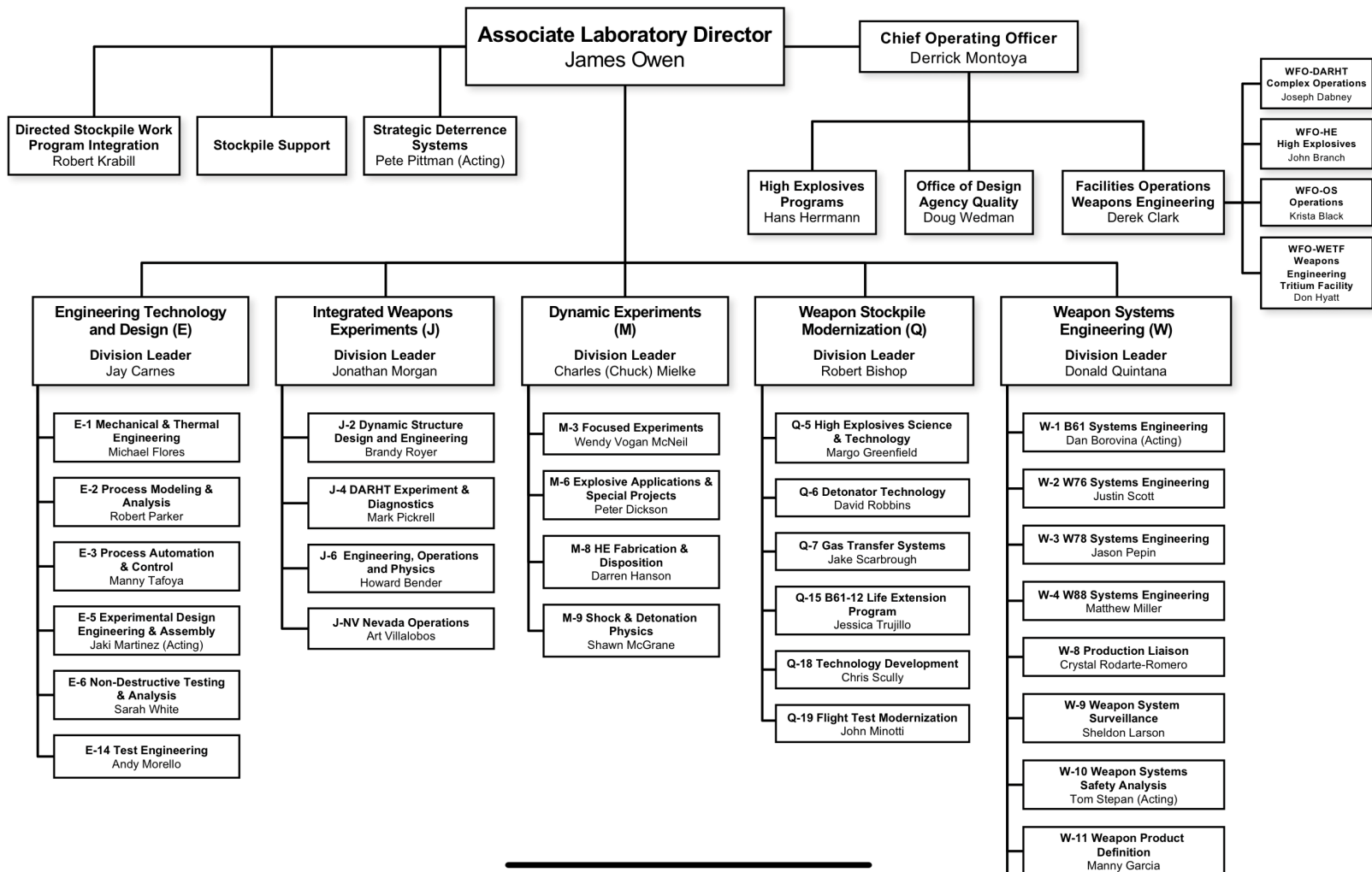
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Weapons Engineering

ALDW – Weapons Engineering Directorate



Los Alamos History of High Explosives and Drive to do Better

- Los Alamos developed and implemented the use of high explosives (HE) to perform complex physics.
- Originally, LANL started with melt-castable explosives (Octol, Comp-B, Tritonal).
- With the drive to miniaturize during the Cold War, focused on the development of plastic-bonded explosives (PBX).
 - Introduction of PBX 9404 was a game changer in weapon design
- However, PBX 9404 was responsible for some terrible accidents and deaths.
- Can we do better? Yes!
 - PBX 9501—Orders of magnitude safer than PBX 9404, with similar performance.
 - PBX 9502—The first “insensitive” high explosive (TATB)—Does not DDT.
 - The stockpile was transformed again, and Los Alamos took the lead.

The High Explosive Chosen for a Weapon Dictates the Design

High Explosives at Los Alamos, the New Renaissance

- Los Alamos has developed two new PBXs—the first in several decades.
 - PBX 9701 – DAAF Based explosive, may be a new IHE with much better performance than PBX 9502
 - PBX 9751, a possible replacement for PBX 9501
- Los Alamos is developing new methods for producing explosives—faster, cheaper, and safer.
 - Extrusion
 - Additive Manufacturing
 - **Particle Injection Modeling (PIM)**
- Los Alamos is working with the other NNSA labs to better understand HE properties in explosive safety and performance — HE grand challenge.
 - Fully interrogate the safety and performance parameter space

Particle Injection Modeling as One Option

- PIM has several goals at LANL.
 - Improve safety of HMX-based explosives
 - Crystal effects
 - Fewer voids
 - Increase throughput at the production plants
 - More near-net shape
 - Less machining and handling
 - Replace the current very hazardous and expensive mock-production methods currently used at LANL and the plants
- Collaboration is a critical goal as well as the key to success
 - EMRTC and LANL collaboration will help make PIM a reality and hopefully generate other ideas and concepts to help move the new HE renaissance forward
 - Collaborations between students, faculty, and LANL staff help develop the nation's future leaders who will keep this nation safe and secure

Closing Remarks

- I am very excited to see the work and capability at EMRTC.
- This is an exciting project that has the chance to change the way we produce HE parts for both the DoD and NNSA.
- Collaboration with EMRTC is critical to the success of this project.
- LANL and EMRTC will need to work together closely to make sure this program is a success and that we all remain safe and secure while doing the work.
- Thanks!

Questions?